REMARKS

This application has been carefully reviewed in light of the Office Action dated October 7, 2003. Claims 1 to 37 and 55 to 78 are now pending in the application, with Claims 38 to 54 having been canceled, and Claims 75 to 78 having been added. Claims 1, 19, 37, 55, 73, 74, 75 and 77 are the independent claims herein. Reconsideration and further examination are respectfully requested.

Applicants wish to thank the Examiner for the indication that Claims 5, 23, 41 and 59 would be allowable if rewritten into independent form. Applicants have chosen not to rewrite the claims into independent form at this time since it is believed that the base claims for each of Claims 5, 23, 41 and 59 are allowable for at least the reasons set forth below.

Claims 1 to 4, 6 to 12, 14, 16, 18 to 22, 24 to 40, 42 to 48, 50, 52 to 54, 60 to 66, 68, 70 and 72 were rejected under § 103(a) over Decker in view of U.S. Patent No. 5,574,664 (Feasey), Claims 13, 15, 17, 31, 33, 35, 49, 51, 53, 67, 69 and 71 were rejected under § 103(a) over Decker in view of Feasey and further in view of U.S. Patent No. 5,073,818 (Iida), and Claims 73 and 74 were rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 6,281,984 (Decker). Reconsideration and withdrawal of the rejections are respectfully requested.

The present invention concerns adjusting a device-independent color appearance space model to account for mismatches between humanly perceived device neutrals and the neutral axis of the device-independent color appearance space. For example, in a device-independent color appearance space, at any given lightness value, corresponding values of hue and chroma can be determined by measuring a sample color patch so that a neutral axis for the device-independent color appearance space can be

determined. However, when sample color patches are printed out, a human being may perceive a patch as being neutral due to surrounding considerations such as background, etc., but in reality, the perceived neutral actually has some chroma. Thus, a mismatch exists between the perceived neutral and the neutral axis of the device-independent color appearance space.

The present invention, unlike any of the applied art, addresses this problem by obtaining mismatch values for the perceived device-neutrals which are perceived as being neutral by a human being, where each mismatch value is a difference between a forward mapped value for the device-neutral and a neutral axis of the device-independent color appearance space. The mismatch values are then used to create an adjusted forward mapping of the device-independent color appearance space values for each lightness level of the device-neutrals, where the device-independent color appearance space, taking into account viewing conditions, defines color coordinates that attempt to describe how colors appear to a viewer. Thus, each value in the adjusted forward mapping are adjusted, not just device neutrals.

Referring specifically to the claims, amended independent Claim 1 is a method for adjusting the representation of a device's color gamut in color appearance space, comprising the steps of performing forward mapping of sample colors from a device-dependent space to a device-independent color appearance space to obtain forward-mapped device-independent values, obtaining mismatch values for perceived device-neutrals which are perceived as being neutral by a human being, each mismatch value being a difference between a forward mapped value for the device-neutral and a neutral axis of the device-independent color appearance space, and adjusting each forward-mapped device-independent color appearance space value by utilizing the obtained mismatch value

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for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping, wherein the device-independent color appearance space, taking into account viewing conditions, defines color coordinates that attempt to describe how colors appear to a viewer.

Independent Claims 19, 37 and 55 are computer-executable process steps, apparatus, and computer-readable medium claims, respectively, that substantially correspond to Claim 1.

Amended independent Claims 73 and 74 include features along the lines Claims 1, 19, 37 and 55, but vary somewhat in scope. Thus, newly-added Claim 73 is an image processing method, comprising the steps of transforming a color measurement value to a device-independent color appearance space value, generating a forward mapping model by using the transformed device-independent color appearance space value, selecting a neutral color in the forward mapping model and adjusting the forward mapping model based on a difference between a device-independent color appearance space value of the selected neutral color and a neutral axis, and inverting the adjusted forward mapping model and generating an inverted forward mapping model, the inverted forward mapping model transforming a device-independent color appearance space value into a device dependent value, wherein the device-independent color appearance space, taking into account viewing conditions, defines color coordinates that attempt to describe how colors appear to a viewer.

Amended independent Claim 74 is a memory medium claim that substantially corresponds to Claim 73.

Newly-added independent Claim 75 is along the lines of Claim 73, but is more specifically directed to an image processing method, comprising the steps of

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transforming a color measurement value to a device-independent color appearance space value, generating a forward mapping model by using the transformed device-independent color appearance space value, selecting neutral colors in the forward mapping model, generating an adjustment value for each color value based on a difference between a device-independent color appearance space value of the selected neutral colors and a color neutral axis, and adjusting the forward-mapped device-independent value based on the adjustment value corresponding to the color value for the forward-mapped device-independent value, wherein the device-independent color appearance space defines color coordinates that attempt to describe how colors appear to a viewer, taking into account viewing conditions.

Newly-added independent Claim 77 is a memory medium claim that substantially corresponds to Claim 75.

The applied art, alone or in any permissible combination, is not seen to disclose or to suggest the features of Claims 1, 19, 37, 55, 73 to 75 and 77. In particular, the applied art is not seen to disclose or to suggest at least the feature of obtaining mismatch values for perceived device-neutrals which are perceived as being neutral by a human being, each mismatch value being a difference between a forward mapped value for the device-neutral and a neutral axis of the device-independent color appearance space. Moreover, the applied art is not seen to disclose or to suggest at least the feature of adjusting each forward-mapped device-independent color appearance space value by utilizing the obtained mismatch value for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping.

Decker operates on a principal entirely different from the present invention. Decker attempts to map CMYK values for a given printer so as to correspond as closely as

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possible with a given external standard (such as the SWOP standard). In performing the mapping, known Lab values for CMYK of a standard are obtained from a table for the standard. In other words, for each CMYK value of the standard, corresponding Lab values are known. The printer in question prints sample greyscale patches in which C=M=Y=0 and the amount of K (black ink) is varied. Each patch is then measured by, for example, a photospectrometer to obtain the L (lightness) value for the patch, but since each patch was printed with black ink only, the values of a and b are presumed to be near zero. Utilizing the known L values of the standard, a corresponding known K value for the standard is determined and at the same L value, a corresponding K' value (percentage of black ink needed to obtain a greyscale patch having lightness value corresponding to the standard) can be determined. Thus, Decker merely performs a direct mapping of K > L > K'. A similar process is then performed utilizing CMYK and Lab values of the standard to compare with C'M'Y'K' and Lab values of printed patches for the printer. Thus, a conversion from CMYK > Lab > C'M'Y'K' is obtained. Therefore, what Decker provides is simply a conversion for a printer to print colors so as to match a known standard, regardless of how a human viewer may perceive the colors, and in particular, how the human viewer may perceive device neutrals. In other words, although the device neutrals printed by the printer may correspond closely with the standard, a human viewer may actually perceive them as having some chroma, but Decker does not take such a perception into account and does not make any adjustment for the human viewer's perception.

In contrast, in one aspect, the present invention adjusts the device-independent color appearance space model based on the human viewer's perception of device neutrals. This is performed by forward mapping sample colors from a device-dependent space to a device-independent color appearance space to obtain forward-mapped

device-independent values. Then, mismatch values are obtained for perceived device-neutrals which are perceived as being neutral by a human being, each mismatch value being a difference between a forward mapped value for the device-neutral and a neutral axis of the device-independent color appearance space. In other words, the present invention, unlike Decker, takes the humanly perceived device neutrals into account to determine the difference between the actual neutral axis of the color appearance space and what the human viewer perceives as being neutral. Decker, on the other hand, obtains a difference between a standard value and a measured value of patches printed by the printer, without any regard as to how the human viewer perceives the colors. The obtained mismatch of the present invention is then used to adjust each forward-mapped device-independent color appearance space value for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping. Thus, the present invention of Claims 1, 19, 37 and 55 is wholly different from Decker in at least this respect.

In addition to the foregoing, Decker also fails to adjust each *forward-mapped device-independent color appearance space value* by utilizing the obtained mismatch value for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping. In this regard, Decker adjusts the printer's color space (i.e., CMYK) values based on corresponding CMYK values of the standard by cross-referencing at the same Lab values. Thus, what is being adjusted in Decker is the printer's color space values and not forward mapped device-independent color appearance space values. Accordingly, Decker fails to disclose or to suggest the features of the present invention as claimed in each of the independent claims.

Feasey is not seen to add anything that, when combined with Decker, would have rendered the present invention obvious. In this regard, Feasey is merely seen to

disclose a method for calibrating color monitors in the textile industry. According to the patent, a user can adjust the white point, grey point and black point as displayed on a computer monitor so that the output on the computer monitor closely matches a reference textile material. Thus, even if Feasey can adjust observed neutrals, it is not seen where in Feasey any mismatch values are obtained for perceived device neutrals and a neutral axis of the device-independent color appearance space. Rather, any mismatch appears to be obtained between the monitor's display and the user (i.e., matching textile color to monitor color), but is not a mismatch between the perceived device neutral and a neutral axis of the device-independent color appearance space.

Moreover, Applicants submit that there simply is no suggestion or motivation to combine Decker and Feasey. In this regard, Decker discloses nothing with regard to adjusting the forward mapped device-independent color appearance space values, much less that the adjustment is performed using obtained mismatch values between perceived device neutrals and a neutral axis of the device-independent color appearance space. While the Office Action asserts that "[i]t would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the color calibration systems of Decker and Feasey because both disclose methods for adjusting a color gamut for printing", the techniques utilized in Decker and Feasey are wholly different from one another. Therefore, other than both references being from the field of adjusting a color gamut, there is no motivation to combine the wholly different techniques so that one skilled in the art would have arrived at the present invention. Moreover, it is readily apparent that, at best, a combination of Decker and Feasey would have provided for a user to view the greyscale patches printed by the printer of Decker on a computer monitor, and to attempt to adjust the color displayed on the monitor to match a patch of the SWOP

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standard so that the corresponding lightness values could then be obtained and the method of Decker could be employed. In other words, the proposed combination still would not have provided for adjusting the forward mapping device-independent color appearance space model based on a difference between a device-independent color appearance space value of a selected neutral color and a neutral axis of the device-independent color appearance space.

Iida is not seen to add anything to overcome the deficiencies of Decker and Feasey. In particular, Iida is not seen to disclose or to suggest at least the feature of obtaining mismatch values for perceived device-neutrals which are perceived as being neutral by a human being, each mismatch value being a difference between a forward mapped value for the device-neutral and a neutral axis of the device-independent color appearance space. Moreover, Iida is not seen to disclose or to suggest at least the feature of adjusting each forward-mapped device-independent color appearance space value by utilizing the obtained mismatch value for each corresponding lightness level of device-neutrals in order to obtain an adjusted forward mapping.

In view of the foregoing deficiencies of the applied art, independent Claims 1, 19, 37, 55, 73 to 75 and 77, as well as the claims dependent therefrom, are believed to be in condition for allowance and such action is respectfully requested at the Examiner's earliest convenience.

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Applicants' undersigned attorney may be reached in our Costa Mesa, California office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,

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